REMARKS/ARGUMENTS

1.) Claim Amendments

The Applicant has amended claims 1, 30, 47, 52, 53, 56, and 61. Claims 2, 4, 31, 50, 51, 54, 55, and 57-60 have been canceled. Claims 64-87 have been added. Accordingly, claims 1, 30, 47, 48, 52, 53, 56, 61-63, 64-87 are pending in the application. Favorable reconsideration of the application is respectfully requested in view of the foregoing amendments and the following remarks.

2.) Claim Rejections – 35 U.S.C. § 103(a)

The Examiner rejected claims 1 and 30 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,146,359 to Okoshi et al. (Okoshi) in view of U.S. Patent No. 7,110,677 to Reingand et al. (Reingand). In response, the Applicant has amended independent claims 1and 30 to more clearly and distinctly claim the subject matter which the Applicant considers as his invention. The consideration of these claims is respectfully requested.

The Applicant has amended independent claim 1 which now recites the electrical signals are multiplied by periodic waveforms and the results of the multiplication are summed and each of the periodic waveforms has frequency and phase equal to an estimate of the frequency and phase of the incoming optical signal with respect to the local oscillator light. Support for these amendments is found in Equation 6 and the associated discussion in the Applicant's specification.

The Applicant's invention multiplies the electrical signals by periodic waveforms and sums the results of the multiplications. Neither Okoshi nor Reingand teach or suggest multiplication of the electrical signals by phase estimate as recited in claim 1. Amended claim 30 recites limitations analogous to claim 1 and is also not taught or suggest in Okoshi or Reingand. Therefore, the allowance of claim 1 and 30 is respectfully requested.

The Examiner rejected claims 2, 4, 31, 47-49, 53, 54, and 56-58 under 35 U.S.C. § 103(a) as being unpatentable over Okoshi in view of Reingand and further in view of

U.S. Patent Application Pub. No. 2002/0012152 to Agazzi et al. (Agazzi). In response, the Applicant has amended independent claims 1and 30 to more clearly and distinctly claim the subject matter which the Applicant considers as his invention. The consideration of these claims is respectfully requested. In addition, the Applicant has canceled claims 2, 4, 31, 54, 57, and 58.

The Applicant has amended independent claim 1 which now recites the digitized electrical signals are formed into a complex number and multiplied by a rotating phase factor which has frequency and phase equal to an estimate of the frequency and phase of the incoming optical signal with respect to the local oscillator light. Support for these amendments is found in Equation 6 and associated discussion in the Applicant's specification.

As discussed above, neither Okoshi nor Reingand teach or suggest multiplication of the electrical signals by phase estimate as recited in claim 1. Okoshi multiplies the electrical signals by sine and cosine functions (components of a rotating phase factor) having frequency much higher than the frequency of the signal compared to the LO. Agazzi does not make up the missing elements. Amended claim 30 recites limitations analogous to claim 1 and is also not taught or suggest by the combination of Okoshi, Reingand, and Agazzi. Claims 47-49 and 53 depend from amended claim 1 and recite further limitations in combination with the novel elements of claim 1. Claim 56 depends from amended claim 30 and recites further limitations in combination with the novel elements of claim 30. Therefore, the allowance of claims 47-49, 53, and 56 is respectfully requested.

In addition, the Applicant has added claim 64 which incorporates the limitations of canceled claim 2 into claim 1 prior to the current amendment. Claim 75 has also been added which incorporates the limitations of canceled claim 31 into claim 30 prior to the current amendment. Therefore, the rejections of claims 2 and 31 will now be address with respect to claims 64 and 75. The Applicant respectfully disagrees with the rejections of claims 2 and 31 with respected to newly added claims 64 and 75. The Applicant's invention, as recited in claims 64 and 75, recite quadrature sampling via A/D converters and digital signal processing. The Examiner stated that these claims are obvious in light of Okoshi, Reingand and Agazzi.

The combination of Okoshi, Reingand and Agazzi is an inoperative combination. Agazzi discloses detecting an optical signal using a photodetector, and then digitizing it with an A/D converter and performing digital signal processing to correct impairments. Agazzi discloses several hardware combinations and signal processing options to restore an impaired signal, but all involve detection of an optical signal by a single photodetector and subsequent processing (see Fig. 1B of Agazzi). There is no teaching or suggestion of sampled signals from two photodetectors being processed together by a digital signal processor. Okoshi discloses signal processing of the two outputs of an optical 90° hybrid via two photodetectors (see Fig. 2 of Okoshi). It is not possible to reconstruct the signal based on only one of these two 90° hybrid outputs. Hence the invention of Agazzi does not operate in combination with the inventions of Okoshi and Reingand, and, therefore, it is not obvious to combine these references.

Furthermore, the Applicant's invention provides unexpected results and therefore is not an obvious modification of existing devices. Okoshi multiplies the two detected (baseband) outputs of the 90° hybrid by $\sin(\omega_{IF}t)$ and $\cos(\omega_{IF}t)$ to form the virtual IF signal. The spectra of the detected signals and the virtual IF signal are drawn as insets as shown in Fig. 3 of Okoshi. These spectra illustrate the fact that the virtual IF has a much wider spectrum than the baseband detected signals. If the signal processing described by Okoshi were to be implemented in a digital signal processor, then the signals within the DSP must be represented by a sequence of sample values at a sampling rate higher than that given by the Nyquist sampling theorem. In the best case, the virtual IF has a maximum frequency equal to the symbol rate, and requires a sample rate of at least 2 x (symbol rate), (i.e., 2 samples per symbol) to represent it. In contrast, with the Applicant's invention, the signals need only 1 sample per symbol to be represented properly. Equation 6 (paragraph 0052 of the Applicant's specification) may be implemented in the DSP with only 1 sample per symbol. The implication of a higher sample rate to represent a signal within a DSP is that more computation resources are needed, which is a disadvantage. The Applicant's claimed invention, therefore has an advantage, an unexpected result, over the combination of Okoshi, Reingand and Agazzi, because it requires a lower sample rate to represent the signal's within the

DSP. The Applicant's invention cannot be considered obvious based on those three prior art references.

Additionally, although not stated explicitly in Okoshi's specification, there is a requirement for equal path lengths in the two parallel paths of Fig. 2 of Okoshi in order for that invention to operate correctly. The paths must be equal to within a fraction of a symbol period. For 10Gbaud symbol rate, for example, this means that the two paths must be equal to within a few millimeters. There are several ways to ensure that the path lengths are equal. The optical fibers and electrical cables joining the components between 11 and 20 could be cut to be equal lengths in the factory. Alternatively, a variable optical delay element or variable electrical delay element could be inserted in one path, and the delay trimmed to ensure equality of path lengths. All these solutions are onerous to some extent. On the other hand, in the Applicant's invention, it does not matter if the optical or electrical paths between the 90° hybrid and the digital signal processor are unequal, because the DSP can be programmed to adjust for path length difference. This point is made in paragraph 0054 of the Applicant's specification. Thus the Applicant's claimed invention differs from the combination of Okoshi, Reingand and Agazzi in that a feature that is onerous to implement is omitted, i.e., the path length equality feature.

In regards to claims 4 and 56, corresponding to added claims 65 and 77, the Examiner also stated that "Regarding claims 4 and 56 in particular, Agazzi et al. further teach that the digital signal processor produces an output which is the result of a signal processing operation on a plurality of samples over time of the complex electric field of the incoming optical signal." The Applicant respectfully disagrees. Agazzi discloses signal processing operations which act on the power of the optical signal, that is the absolute value of the electric field squared. Signal processing of the power is a different principle of operation as compared to signal processing of the electric field. It is not able to implement the same range of features, as is made clear in paragraph 0110 of the Applicant's invention. By operating on the electric field, it is possible to exactly reverse any deterministic fiber propagation effect, while only partial compensation, at best, is possible by operating on the power. Furthermore, the insertion of an arbitrary optical component can be emulated by a signal processing operation that acts on the

electric field of the signal, but not by a signal processing operation that acts on the power. The fact that large deterministic impairments may be exactly reversed by the Applicant's invention, which has signal processing of the electric field, but not by Agazzi, which operates on the power, means that there is a synergy by combining coherent detection with digital signal processing. This synergistic behavior is an unexpected result. Thus, the different principle of operation and the unexpected synergistic result are two reasons why the combination of Okoshi and Reingand's coherent receiver with Agazzi's DSP receiver cannot be considered obvious.

Claim 47 and claim 77 (corresponding to canceled 57) refer to compensation of fiber propagation impairments. The Examiner stated that these claims are obvious in light of the combination of Okoshi, Reingand and Agazzi. In fact, Agazzi's invention operates on the power of the optical signal while the Applicant's invention operates on the electric field. This means that Agazzi can compensate only for small propagation impairments, and the compensation is partial compensation. In contrast, the Applicant's invention can compensate in principle for an arbitrarily large amount of a deterministic fiber propagation impairment, and the compensation completely restores the signal instead of partially restoring it. Thus there is a synergy, an unexpected result, by combining the coherent detection of Okoshi and Reingand with the fiber propagation effect compensation of Agazzi. The Applicant's claimed invention cannot be considered obvious in light of the combination of these prior art references.

Furthermore, the prior art teaches against the Applicant's invention. As is made clear in paragraph 0080 of the Applicant's specification, the use of coherent detection means that any electrical domain equalization effectively acts on the electric field of the optical signal. The Applicant's invention is able to reverse completely any deterministic propagation impairment, such as chromatic dispersion or polarization mode dispersion (PMD). It is similarly possible to reverse completely a deterministic propagation impairment using optical domain equalization, since optical equalization also acts on the optical signal's electric field. However it is not possible to reverse completely such a propagation impairment using electrical equalization following direct detection, because the direct detection process discards the phase and polarization information about the optical signal – the photodetector is a square law, or nonlinear, device.

In "On the Performance of Electrical Equalization in Optical Fiber Transmission Systems" by A.J. Weiss (IEEE Phot. Tech. Lett., vol. 15, no. 9, p. 1225-1227, 2003) the best possible performance is calculated of electrical equalizers following photodetection. The optical signal is impaired by chromatic dispersion and PMD, which cause intersymbol interference (ISI). The author considers MLSE equalization, because it is as good or better than any other type of equalization, such as FFE or DFE. The conclusion of the paper states that:

"It is well known that in the presence of ISI, MLSD [same as MLSE] achieves the best performance ... its performance can be used as a lower bound on any electrical equalization performance. On the other hand, ideal optical equalizers can eliminate ISI by constructing the near-inverse transfer function of the optical fiber, as long as the nonlinear effects are negligible. ... Our numerical results indicate that in the presence of ISI, the performance of an ideal electrical equalizer is degraded with respect to the impairment-free case. The reason for this degradation is the nonlinear operation of the photodetector."

This paper teaches that the best possible electrical equalizer cannot completely reverse the effect of ISI due to fiber propagation effects, while optical domain equalizers can. In fact, the electrical domain equalizer of the Applicant's invention can completely reverse the ISI due to fiber propagation effects, like an optical domain equalizer. The Applicant has demonstrated this by compensating exactly for chromatic dispersion, as described in "Coherent detection method using DSP for demodulation of signal and subsequent equalization of propagation impairments" by M.G. Taylor (IEEE Phot. Tech. Lett., vol. 16, no. 2, p. 674-676, 2004). The result of the present invention is therefore contrary to the teaching of prior art. The present invention gives new and unexpected results, and is not obvious.

Another paper, "Electronic PMD mitigation-from linear equalization to maximum-likelihood detection," by H. Bulow & G. Thielecke (OFC 2001 conference, Anaheim, US, paper WAA3, 2001) compares compensation of PMD by three electrical equalization methods: FFE, DFE and MLSE. Although the paper focuses on PMD, the same behavior can be expected of other fiber propagation impairments such as chromatic dispersion. The conclusion of the paper is:

"The ultimate performance of electronic signal processing can be achieved by a maximum-likelihood sequence detection scheme (MLSD) exhibiting a theoretical limit of only 1dB (thermal noise limited) which is due to the loss of polarization (and phase) information of the optical signal during the square-law detection process before equalization."

Again, this paper teaches that PMD cannot be completely compensated, i.e. 0dB penalty, using electrical equalization.

The result of the Applicant's invention is contrary to the teaching of the prior art, as exemplified by the two aforementioned research papers. One who wishes to compensate exactly for fiber propagation impairments is directed by the prior art **not** to use electrical domain equalization. Since the prior art teaches against combining the receiver of Okoshi and Reingand with the electrical domain equalizer of Agazzi, the combination cannot be considered to be obvious.

Claims 48, 49 and newly added claim 79 (corresponding to canceled claim 58) are directed to compensation of fiber chromatic dispersion. The Examiner stated that these claims are obvious in light of the combination of Okoshi, Reingand and Agazzi. The Applicant respectfully disagrees. In fact Agazzi's invention operates on the power of the optical signal while the Applicant's invention operates on the electric field. This means that Agazzi can compensate only for a small amount of chromatic dispersion, and the compensation is partial compensation. In contrast, the Applicant's invention can compensate in principle for an arbitrarily large amount of chromatic dispersion, and the compensation completely restores the signal instead of partially restoring it. For example, in the research paper co-authored by the Applicant "Digital Equalisation of 40Gbit/s per Wavelength Transmission over 2480km of Standard Fibre without Optical Dispersion Compensation" by S.J. Savory et al. (ECOC 2006 conference, Cannes, France, paper Th2.5.5, Sep. 2006) a 10Gbaud signal is transmitted over 2480km of standard single mode fiber, with the chromatic dispersion compensation being performed using the method of the Applicant's invention. On the other hand, the paper "Measurement of the dispersion tolerance of optical duobinary with an MLSE-receiver at 10.7 Gb/s" by J.P. Elbers et al. (OFC 2005 conference, Anaheim, US, paper OThJ4, Mar. 2005) uses the chromatic dispersion compensation method of Agazzi, and

achieves a dispersion tolerance at 10Gbaud of only 4000ps/nm, equivalent to 240km of standard single mode fiber. Thus there is a synergy, an unexpected result, by combining the coherent detection of Okoshi and Reingand with the chromatic dispersion compensation of Agazzi. Therefore, the Applicant's claimed invention cannot be considered obvious in light of the combination of these prior art references.

Claims 53 and newly added claim 73 (corresponding to canceled claim 54) are directed to adaptive equalization of impaired signals. Agazzi's invention operates on the power of the optical signal while the Applicant's invention operates on the electric field. This means that Agazzi can compensate only for small propagation impairments, and the compensation is partial compensation. In contrast, the Applicant's invention can compensate in principle for an arbitrarily large amount of a deterministic fiber propagation impairment, and the compensation completely restores the signal instead of partially restoring it. Thus there is a synergy, an unexpected result, by combining the coherent detection of Okoshi and Reingand with the fiber propagation effect compensation of Agazzi. Therefore, the Applicant's claimed invention cannot be considered obvious in light of the combination of these prior art references.

For the above stated reasons, the combination of Okoshi, Reingand and Agazzi is improper for claims 64 and 75. Claims 65-74 depend from claim 64 and recite further limitations in combination with the novel elements of claim 64. Claims 76-86 depend from claim 75 and recites further limitations in combination with the novel elements of claim 75. Therefore, the allowance of claims 64-86 is respectfully requested.

The Examiner rejected claims 51 and 59 under 35 U.S.C. § 103(a) as being unpatentable over Okoshi in view of Reingand And Agazzi and further in view of U.S. Patent Application Pub. No. 2002/0126644 to Turpin et al. (Turpin). In response, the Applicant has canceled claims 51 and 59. However, claims 70 and 80 have been added, which correspond to canceled claims 51 and 59. The Applicant traverses the rejection.

Claims 70 and 80 are directed to the compensation of impairment of the optical signal from multipath interference (MPI). The Examiner stated that claims 51 and 59 are obvious in light of the combination of Okoshi, Reingand, Agazzi and Turpin. The Applicant respectfully disagrees. Turpin discloses an improvement to a code division

multiple access (CDMA) communications system using an optical correlator component. The Examiner points out that Turpin's specification mentions that the CDMA modulation format may be applied to an optical signal using existing techniques, and elsewhere Turpin states that an existing multipath interference compensation method may be included. The Examiner stated that putting these features together with the coherent DSP receiver of Okoshi, Reingand and Agazzi makes the Applicant's invention obvious.

However, the two features of Turpin to which the Examiner has drawn attention, optical domain CDMA and MPI compensation, may not be implemented in the same communications system. Turpin does not state explicitly that they cannot be combined, and by mentioning the two features in different contexts provides no indication that it was well known and thus, could be combined. The reason that optical CDMA and MPI compensation cannot be combined is that the existing MPI compensation methods, such as the RAKE method referred to by Turpin in paragraph 0055, operate on the electric field of the signal that is impaired by MPI. The most common application of CDMA is in radio signals where the electric field is readily available, and most of the applications listed in Turpin's paragraph 0047 are indeed radio applications. However, in optical CDMA the power of the optical signal, and not the electric field, is modulated, and the power is available at the receiver. The existing MPI compensation methods will not work in this scenario. Although they are both mentioned in the same prior art reference, Turpin, existing MPI compensation and optical CDMA methods will not operate together.

The Applicant's claimed invention, on the other hand, explains how the electric field of the optical signal may be made available within the DSP, and teaches how to compensate for MPI. Therefore, the Applicant's invention cannot be considered obvious in light of the cited prior art references. Therefore, the allowance of claims 70 and 80 are respectfully requested.

The Examiner rejected claims 52, 55, and 60 under 35 U.S.C. § 103(a) as being unpatentable over Okoshi in view of Reingand and Agazzi and further in view of U.S. Patent No. 7,110,683 to Bessios (Bessios). In response, the Applicant has amended independent claims 1 to more clearly and distinctly claim the subject matter which the Applicant considers as his invention. The consideration of this amended claim is

respectfully requested. In addition, Claims 55 and 60 have been canceled. However, claims 74 and 81 have been added and correspond to canceled claims 55 and 60.

The Applicant has amended independent claim 1 which now recites the digitized electrical signals are formed into a complex number and multiplied by a rotating phase factor which has frequency and phase equal to an estimate of the frequency and phase of the incoming optical signal with respect to the local oscillator light. Support for these amendments is found in Equation 6 and associated discussion in the Applicant's specification.

As stated above, the combination of Okoshi, Reingand and Agazzi does not teach or suggest the Applicant's invention as recited in claim 1. The addition of Bessios does not make up the missing elements. Claim 52 depends from amended claim 1 and recites further limitations in combination with the novel elements of claim 1.

Furthermore, claims 52 and 81 are directed to the application of digital signal processing to execute an optical filter function on the electric field of the optical signal. The Examiner stated that these claims are obvious in light of the combination of Okoshi, Reingand, Agazzi and Bessios. Bessios describes a fiber optic receiver that compensates for PMD by using maximum likelihood sequence estimation (MLSE). The receiver uses A/D conversion and digital signal processing, which is necessary to implement MLSE. The signal that has been distorted by PMD is transformed into a special class of distorted signal called partial response signal which is known to work well with MLSE. Bessios discloses a filter operation, which Bessios calls spectral shaping, to transform the actual signal within the receiver distorted by PMD into a partial response-type signal. The Examiner has identified the components for spectral shaping and states that "Bessios further teaches performing digital signal processing operations including an optical filtering function on the complex envelope of the electric field of the incoming signal." The Applicant respectfully disagrees. In fact, the filter operation in Bessios is not an optical filtering function. It does not act on the complex envelope of the electric field since that parameter is not available within Bessios' receiver. The receiver clearly includes a photodetector, although Bessios does discuss the photodetector or its location. Figure 1 of Bessios has an optical signal at the input and an electrical data signal (produced by the MLSE) at the output. The digitizer 204 is an

electrical domain component, and so the photodetector must be located prior to this component. Therefore, the spectral shaping operation that occurs within the spectral-shaping MLSE detector 205 refers to a filtering operation **following** photodetection. In a research paper describing the same material as the patent application, "Polarization mode dispersion compensation for 10 Gbps over single mode fiber" (Thirty-Fifth Asilomar Conference on Signals, Systems and Computers, 2001, Pacific Grove, CA), Bessios states that a PIN photodetector is used and provides further details about it.

A filtering operation following photodetection cannot have the same result as an optical filtering operation, because the phase information of the optical signal is discarded upon photodetection. To make the distinction clear, if an optical signal contains two wavelengths having different modulation, an optical filter is able to pass one wavelength and reject the other. However, following photodetection the electrical signal is the sum of the two modulated powers, and it is not possible to pass the modulation from one wavelength and reject the modulation from the other.

Bessios' invention does not perform an optical filtering function. The Applicant's invention, however, teaches how to make the optical signal's electric field available within the digital signal processor, and explains how to perform an optical filtering function. Therefore, the Applicant's claimed invention is not obvious in light of the combination of Okoshi, Reingand, Agazzi, and Bessios.

In regards to claim 74, which corresponds to claim 55, the Applicant's claim invention is directed to adaptive equalization by maximum likelihood sequence estimation (MLSE). The Examiner stated that these claims are obvious in light of the combination of Okoshi, Reingand, Agazzi and Bessios. The Applicant respectfully disagrees with this characterization. In fact, Agazzi's and Bessios' inventions operate on the power of the optical signal while the Applicant's invention operates on the electric field. This means that Agazzi and Bessios can compensate only for small propagation impairments. In contrast, the Applicant's invention can compensate in principle for an arbitrarily large amount of a deterministic fiber propagation impairment, and the compensation completely restores the signal instead of partially restoring it. Thus there is a synergy, an unexpected result, by combining the coherent detection of Okoshi and Reingand with the fiber propagation effect compensation of Agazzi and Bessios. The

Applicant's claimed invention cannot be considered obvious in light of the combination of these prior art references.

Therefore, for the above stated reasons, the Applicant's claimed invention is not obvious in light of the cited references. Therefore, the allowance of claims 52, 74 and 81 is respectfully requested.

The Examiner rejected claim 50 under 35 U.S.C. § 103(a) as being unpatentable over Okoshi in view of Reingand And Agazzi and further in view of U.S. Patent Application Pub. No. 2002/0060827 to Agazzi (Agazzi '827). The Applicant has canceled claim 50. However, claim 69 has been added, which corresponds to canceled claim 50.

Claim 69 is directed to compensation of the self phase modulation (SPM) fiber propagation impairment. The Examiner stated that this claim is obvious in light of the combination of Okoshi, Reingand, Agazzi, and Agazzi '827. Two passages are cited from Agazzi '827 to indicate that this invention uses digital signal processing to compensate for SPM. The first passage (paragraph 0011 of Agazzi '827) is in the "Background to the invention" section, and states that self phase modulation is one of the nonlinear refractive index effects associated with optical fiber propagation. The second passage (paragraphs 0081 to 0087 of Agazzi '827) describes the nonlinear channel equalizer. In fact, the nonlinear channel equalizer does not have the purpose of equalizing nonlinear refractive index effects, such as SPM. The term "nonlinear" is overused in engineering, and has two different meanings in the Agazzi '827 patent application. The equalization process in Agazzi '827 is divided into two sections: linear equalization by element 1317, and nonlinear equalization by element 1300. "Linear" and "nonlinear" here mean that the output of the equalizer is either a mathematically linear or nonlinear operation on the input. For example, the feedforward equalizer is a linear equalizer, while the decision feedback equalizer is nonlinear. The nonlinear refractive index of optical fiber is a specialist term in comparison, and refers to the electric field at the output of the optical fiber not being linear with the electric field at the input to the fiber. Propagation effects, such as chromatic dispersion and PMD, are linear propagation effects, but require nonlinear equalization. The reason for this is that the output of a photodetector is the absolute value squared of the electric field, so that

effects that are linear with the optical signal electric field become nonlinear when photodetection is included. There is nothing in the second passage cited by the Examiner to indicate the nonlinear equalizer refers to the equalization of fiber nonlinear effects. One skilled in the art would read the passage as referring to a nonlinear equalizer which may be applied to compensate for a variety of signal impairments, such as linear fiber propagation effects. The nonlinear equalizer is not directed towards nonlinear fiber propagation effects such as SPM.

Therefore the combination of prior art references cited does not make the Applicant's invention obvious. Therefore, the allowance of claim 69 is respectfully requested.

The Examiner rejected claims 61-63 under 35 U.S.C. § 103(a) as being unpatentable over Okoshi in view of Reingand and Agazzi and further in view of U.S. Patent No. 6,6607,311 to Fishman et al. (Fishman) and U.S. Patent No. 6,381,995 to Spickerman et al. (Spickerman). In response, the Applicant has amended independent claim 30 to more clearly and distinctly claim the subject matter which the Applicant considers as his invention. The consideration of this claim is respectfully requested.

The Applicant has amended independent claim 30 which now recites the digitized electrical signals are formed into a complex number and multiplied by a rotating phase factor which has frequency and phase equal to an estimate of the frequency and phase of the incoming optical signal with respect to the local oscillator light. Support for these amendments is found in Equation 6 and associated discussion in the Applicant's specification.

The Applicant's invention multiplies the electrical signals by a factor based on the phase estimate. Neither Okoshi nor Reingand teach or suggest multiplication of the electrical signals by phase estimate as recited in claim 30. The addition of Agazzi, Fishman, and Spickerman do not make up the missing elements.

Claim 61 is directed to crosstalk subtraction via digital signal processing. Claims 62 and 63 are dependent on claim 61 and cover cross phase modulation (XPM) and four wave mixing (FWM) compensation respectively. The Examiner stated that these claims are obvious in light of the combination of Okoshi, Reingand, Agazzi, Fishman and Spickerman. The Applicant respectfully disagrees.

Fishman discloses an optical transmission system using direct detection that is not as heavily impaired as conventional systems when there is WDM crosstalk. Spickerman discloses the use of cross-tap equalization to reduce crosstalk between WDM channels when there is inadequate optical filtering.

The Applicant has amended independent claim 30. As discussed above, the combination of Okoshi, Reingand and Agazzi does not teach or suggest multiplication of the electrical signals by phase estimate as recited in claim 30. The addition of Fishman and Spickerman do not make up the missing elements. Claims 61-63 depend from amended claim 30 and recite further limitations in combination with the novel elements of claim 30. Therefore, the allowance of claims 61-63 is respectfully requested.

CONCLUSION

In view of the foregoing remarks, the Applicants believe all of the claims currently pending in the Application to be in a condition for allowance. The Applicants, therefore, respectfully request that the Examiner withdraw all rejections and issue a Notice of Allowance for claims1, 30, 47, 48, 52, 53, 56, 61-63, and 64-87.

The Applicants request a telephonic interview if the Examiner has any questions or requires any additional information that would further or expedite the prosecution of the Application.

Respectfully submitted,

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Date: 6-18-2008

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